



UNITED STATES PATENT AND TRADEMARK OFFICE

W
UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|-----------------------|------------------|
| 10/520,385 | 01/03/2005 | Takashi Ishii | 20239/0202029-US0 | 2540 |
| 7278 | 7590 | 08/25/2006 | | EXAMINER |
| DARBY & DARBY P.C. P. O. BOX 5257 NEW YORK, NY 10150-5257 | | | MATTHEWS, COLLEEN ANN | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2811 | |

DATE MAILED: 08/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|------------------------|---------------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/520,385 | ISHII ET AL. |
| | Examiner | Art Unit |
| | Colleen A. Matthews | 2811 |

– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 10 April 2006.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-13 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) Notice of Informal Patent Application (PTO-152)
- 6) Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1-5, 7-8 and 10** are rejected under 35 U.S.C. 103(a) as being unpatentable over applicants' acknowledged prior art (APA) of Figure 4 in view of U.S. Pat. No. 4,137,076 to Hoyer et al. (Hoyer).

3. **Regarding claims 1-2**, APA of Figure 4 discloses a submount substrate (3) and a solder layer (108) comprising at least a first metal and a second metal in a specific mass ratio formed on a primary surface of a submount substrate (4f). APA discloses use of gold-tin, silver-tin and lead-tin alloys for the solder layer (specification page 2 lines 18-20).

APA fails to disclose the relative density of the solder layer before melting as at least 50% and no more than 99.9% of the theoretical density of the solder layer. Hoyer teaches a solder layer formed with a relative density as 96%-98% of the theoretical density (col 3 lines 41-43) of the solder layer which falls within the range of 50%-99.9%. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the APA to include the relative density of the solder layer before melting as at least 50% and no more than 99.9% of the theoretical density of the solder layer as in Hoyer in order to have low electrical resistance in the layer.

4. **Regarding claim 3**, the solder layer before melting describes an intermediate product of the submount assembly, which cannot serve to structurally distinguish the claimed submount from APA of Figure 4.
5. **Regarding claim 4**, APA of Figure 4 discloses a submount (3) having an electrode layer (6) formed between the submount substrate (4) and the solder layer (108).
6. **Regarding claim 5**, APA discloses the electrode layer containing gold (specification page 2 lines 1-2).
7. **Regarding claim 7**, APA of Figure 4 discloses an adhesion layer (5) and a diffusion barrier layer (5) formed between the submount substrate and the solder layer where the adhesion layer is formed on the primary surface of the submount substrate (4f) and the diffusion barrier is formed on the adhesion layer (specification page 1 lines 22-23 and page 2 line 1).
8. **Regarding claim 8**, APA of Figure 4 discloses an adhesion layer contains titanium and diffusion layer contains platinum (specification page 1 lines 22-23 and page 2 line 1).
9. **Regarding claim 10**, APA of Figure 4 discloses a semiconductor device comprising a submount (3) and a semiconductor light-emitting element (2) mounted on the solder layer (108) of the submount.
10. **Regarding claim 11**, APA of Figure 4 discloses the first metal layer as gold (spec page 2 line 3). The APA fails to disclose the first layer made of at least 65% by mass and no more than 85% by mass, or at least 5% by mass and no more than 20% by mass of the solder layer. However, this percentage is regarded as nothing more than an

obvious design variation of the percentage of the first layer by mass and the variation could be easily ascertained through routine experimentation. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made have the first layer made of at least 65% by mass and no more than 85% by mass, or at least 5% by mass and no more than 20% by mass of the solder layer to maximize the performance of the device.

11. Regarding claim 12, APA of Figure 4 discloses the first metal layer as silver (spec page 2 line 19). The APA fails to disclose the first layer as no more than 72% by mass of the solder layer. However, this percentage is regarded as nothing more than an obvious design variation of the percentage of the first layer by mass and the variation could be easily ascertained through routine experimentation. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made the first layer as no more than 72% by mass of the solder layer to maximize the performance of the device.

12. Regarding claim 13, APA discloses a submount substrate (3) and a solder layer (108) comprising at least a first metal and a second metal in a specific mass ratio formed on a primary surface of a submount substrate (4f).

APA fails to disclose the relative density of the solder layer before melting as at least 50% and no more than 99.9% of the theoretical density of the solder layer. Hoyer teaches a solder layer formed with a relative density as 96%-98% of the theoretical density (col 3 lines 41-43) of the solder layer which falls within the range of 50%-99.9%. It would have been obvious to one of ordinary skill in the art at the time the invention

was made to modify the APA to include the relative density of the solder layer before melting as at least 50% and no more than 99.9% of the theoretical density of the solder layer as in Hoyer in order to have low electrical resistance in the layer.

The claim also recites, "the solder layer is formed using a solder film-formation rate of at least 1.3 nm/sec" which is a method of step, however the claim is to an apparatus. Therefore, this language amounts a product by process limitation, which will not be given patentable weight. "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

13. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over by applicants' acknowledged prior art (APA) of Figure 4 in view of U.S. Pat. No. 4,137,076 to Hoyer et al. (Hoyer) in further view of U.S. Pat. No. 6,521,477 to Gooch et al.

14. Regarding claim 6, the APA of Figure 4 differs from the claimed invention in not disclosing the solder adhesion layer (107) containing a noble metal layer disposed on the solder layer side and containing at least one of the following gold, platinum, palladium, and a transition element layer disposed on the electrode layer side containing at least one of titanium, vanadium, chromium, zirconium, niobium. Gooch et

al. teaches a solder adhesion layer in Figure 7 where the adhesion layer is comprised of a combination of metals or metal alloys, preferably a first layer of titanium, followed by a layer of palladium (column 6 lines 21-27). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use a combination of metals or metal allows such as a layer of titanium followed by a layer of palladium as in Gooch et al. as the solder adhesion layer between the solder layer and the electrode layer in the APA of Figure 4. One would have been motivated to modify the solder adhesion layer to have two layers of metal in order to provide a surface for the solder that is better suited for secure attachment of a device.

15. **Claim 9** is rejected under 35 U.S.C. 103(a) as being unpatentable over by applicants' acknowledged prior art (APA) of Figure 4 in view of U.S. Pat. No. 4,137,076 to Hoyer et al. (Hoyer) in further view of U.S. Pat. No. 4,585,706 to Takeda et al.

16. **Regarding claim 9**, the APA of Figure 4 differs from the claimed invention in not disclosing the submount substrate containing sintered aluminum nitride or sintered alumina. Takeda et al. teaches a submount substrate (20) containing sintered aluminum nitride (claim 1 in column 10). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use a submount substrate containing sintered aluminum nitride or sintered alumina as in Takeda et al. as the material for the submount substrate in the APA of Figure 4. One would have been motivated to modify the material of the submount substrate to sintered aluminum nitride

or sintered in order to make a compact substrate that is electrically insulating, heat-resistant, and has a high mechanical strength at high temperature.

Response to Arguments

3. Applicant's arguments with respect to claims 1-10 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

4. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen A. Matthews whose telephone number is 571-272-1667. The examiner can normally be reached on Monday - Friday 8AM-4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CAM
08/17/2006



EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800